**DNA Isolation from Strawberries**

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*http://www.caseciw.org/first\_light\_case/horn/strawberries/strawbdnaproc.html*

**Teacher Background**

This is a simple, effective protocol for spooling DNA. Ripe strawberries are an excellent

source for extracting DNA because they are easy to pulverize and contain enzymes

called pectinases and cellulases that help to break down cell walls. And most important,

strawberries have eight copies of each chromosome (they are octoploid), so there is a

lot of DNA to isolate.

The purpose of each ingredient in the procedure is as follows:

**Shampoo or dishwasher soap** helps to dissolve the cell membrane, which is a lipid

bilayer.

**Sodium chloride** helps to remove proteins that are bound to the DNA. It also helps to

keep the proteins dissolved in the aqueous layer so they don’t precipitate in the alcohol

along with the DNA.

**Ethanol or isopropyl alcohol** causes the DNA to precipitate. When DNA comes out of

solution it tends to clump together, which makes it visible. The long strands of DNA will

wrap around the stirrer or transfer pipette when it is swirled at the interface between the

two layers.

**Notes on Materials and Recipes**

• Use Ziploc TM freezer bags rather than sandwich bags, as they are thicker.

• Fresh or frozen strawberries can be used. Be sure to thaw the frozen berries at room

temperature. Bananas or kiwi fruit can also be used but yield less DNA.

• Use non-iodized table salt or laboratory-grade sodium chloride.

• 95% ethanol or 91 or 100% isopropyl alcohol can be used to precipitate the DNA.

Isopropyl alcohol can be purchased from a pharmacy. Whichever you use, make sure

it is ice cold by placing in an ice-water bath or in the freezer.

**DNA Extraction Buffer**

• 100 ml (3/8 cup) shampoo (without conditioner) or 50 ml dishwasher detergent

• 15 grams sodium chloride (2 teaspoons)

• water to 1 liter

*The GENETICS Project Department of Genome Sciences University of Washington*

*http://chroma.mbt.washington.edu/outreach/genetics*

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**NAME: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ DATE: \_\_\_\_\_\_\_\_ PER. \_\_\_\_**

**DNA ISOLATION FROM STRAWBERRIES**

**Objective**: In this lab students will extract DNA from Strawberries and then view the structure under a microscope.

**Background**

The process of isolating DNA from a cell is the first step in many laboratory procedures in biotechnology. The scientists must be able to separate the DNA from the unwanted substances of the cell gently enough so that the DNA is not broken up and shredded.

The solution of salt and detergent causes the cell membrane to break down and emulsifies (breaks down) the lipids and proteins of the cell by disrupting the interactions that hold the cell membrane together. The detergent forms complexes with the lipids and proteins causing them to precipitate (fall to the bottom) out of the solution. NaCl (salt) allows nucleic acids to precipitate out of an alcohol solution in the last step of this process..

Last, you will add ice cold ethanol to the test tube to make your DNA precipitate (fall out) of the detergent/NaCl solution. DNA precipitates out because *DNA is not soluble in ice cold ethanol. When ethanol is added to the mixture, all the parts of the mixture* ***except*** *the DNA stay in solution while the DNA precipitates out.*

**Materials per group**

* 2 strawberries
* 20 ml DNA Extraction Buffer (soapy salty water)
* 20 ml ice cold ethanol (ask for when you are ready to add it.)
* Ziploc
* test tube
* 1 funnel lined with a moistened coffee filter
* 1 stirring rod
* toothpicks
* microscope slides
* scissors
* small drop of methylene blue

**Procedure:**

1. Place strawberries into a Ziploc bag and seal shut.

2. Squish for a few minutes to completely squash the fruit.

3. Add 20 ml DNA Extraction Buffer (soapy salty water) and squish for a few more

minutes. Try not to make a lot of soap bubbles.

***REMEMBER:* The liquid detergent causes the cell membrane to break down and emulsifies (breaks down) the lipids and proteins of the cell by disrupting the interactions that hold the cell membrane together. The detergent combines with the lipids and proteins causing them to precipitate (fall) out of the solution. NaCl enables nucleic acids to precipitate out of an alcohol solution in the last step of this purification because it shields the phosphate end of DNA, causing them to come together.**

4. Filter through a moistened coffee filter set in a funnel, and collect the liquid in a

clear tube. *Do not* squeeze the paper towel. Let drip until all liquid is gone from coffee filter.

5. Add 20 ml ice cold ethanol to the strawberry liquid in the tube. ***Pour the ethanol carefully down the side of the test tube so that it forms a separate layer on top of the strawberry liquid***.

**REMEMBER: DNA is not soluble in ice cold ethanol. When it is added to the mixture, all the components of the mixture *EXCEPT* the DNA stay in solution while the DNA precipitates out.**

6. Watch for about a minute. What do you see? You should see a white fluffy cloud at

the interface between the two liquids. That’s DNA!

7. Spin and stir the stirring in the tangle of DNA, wrapping the DNA around the stirrer.

8. Pull out the stirrer and transfer the DNA to a clean microscope slide. The

fibers are thousands and millions of DNA strands.

9. To view in a microscope, put a very, very small amount of DNA on a clean slide and gently tease/stretch apart using 2 toothpicks. The fibers will be easier to see in the

teased-apart area.

***MAKE SURE YOUR PIECE OF DNA TO VIEW IS VERY, VERY SMALL!***

10. Place a very small drop of methylene blue onto the DNA to be viewed.

11. View under the microscope. Draw the spooled DNA on both HIGH and LOW power.

**REMEMBER: Use your diagramming rules!**

12. Clean your stations completely:

* Scrub your test tube with a brush
* Place test tube upside down in test tube holder
* Throw out Ziploc bag
* Wash out funnel
* Throw out coffee filter
* Wash glass stirring rod
* Wipe down your lab table.

**PRE LAB QUESTIONS:**

1. What do you think the DNA will look like?

2. Where is DNA found?

3. Why do we use a detergent/NaCl solution in this experiment?

4. What is the purpose of the cold ethanol?

**ANALYSIS QUESTIONS**

1. Why was the detergent/NaCl solution necessary?

2. How does the addition of cold ethanol help extract the DNA?

**CONCLUSION:**

1. What is the benefit to society to be able to extract DNA?

2. Research the Human Genome Project? What is it and why is it important?

3. Some people are concerned that we may be able to manipulate the DNA of people and that it will change them into something that they are not. Can you give some examples of the types of human genes that might be changed? Do you think that scientists should continue with this type of research? Why or why not?

4. It is important that you understand the steps in the extraction procedure and why each step was necessary. Each step in the procedure aided in isolating the DNA from other cellular materials. Match the procedure with its function:

**PROCEDURE FUNCTION**

\_\_\_\_\_\_\_ Filter strawberry through coffee filter A. To precipitate DNA from solution

B. Separate components of the cell

\_\_\_\_\_\_\_ Mix strawberry with detergent/NaCl C. Break open cells.

Solution

\_\_\_\_\_\_\_ Initial mashing of the strawberry D. Break up proteins & dissolve cell

\_\_\_\_\_\_\_ Addition of ethanol to test Tube.

5. What did the DNA look like? (think of DNA structure lab).

# 6. Is there DNA in your food? \_\_\_\_\_\_\_\_ How do you know?Glossary

**Clone** An exact genetic copy of an organism or a gene.

**Deproteinization** The process of removing proteins clinging to the surface of the DNA molecule and those found in the core of the DNA molecule.

**DNA** Genetic material found in all of our cells. DNA is an abbreviation for deoxyribo nucleic acid.

**Lysing** The process of breaking open cells.

**Precipitation** The process of bringing compounds out of solution. DNA comes out of solution in alcohol, so visible DNA forms at the surface where the alcohol and cell sample meet.

###### Prokaryotes Single-celled organisms, including bacteria, which do not have a nucleus.

**Protease** An enzyme that breaks down or denatures protein.

**Protocol** Set of directions for a lab procedure. Protocols are similar to recipes.

**Restriction Enzymes** Enzymes that cut DNA at specific base sequences.